Emilio C. Piesciorovsky – Curriculum Vitae

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Professional media: https://www.linkedin.com/in/emilio-piesciorovsky-7a72523a/

Research media: https://www.researchgate.net/profile/Emilio_Piesciorovsky

Education:

Year	Institution	Degree
2015	Kansas State University, Manhattan, KS	Philosophy Doctor in Electrical Engineering
2009	Kansas State University, Manhattan, KS	Master of Sciences in Electrical Engineering
2002	La Plata National University, Buenos Aires, Argentina	Master in International Marketing
1995	National Technologic University, Buenos Aires, Argentina	Electrical Engineer

PhD EE Thesis: Relay in the Loop Test Procedures for Adaptive Overcurrent Protection. Kansas State University, College of Engineering, Department of Electrical and Computer Engineering. Co-Major Professors: Noel N Schulz and Anil Pahwa, 2015. https://krex.k-state.edu/dspace/handle/2097/20537

MS EE Thesis: Heat Gain from Power Panelboard. Kansas State University, College of Engineering, Department of Electrical and Computer Engineering. Co-Major Professors: Warren White and Anil Pahwa, 2009. http://krex.k-state.edu/dspace/handle/2097/2348

M Mktg Thesis: Marketing Annual Plan for the Technologic High School No1. La Plata National University, College of International Marketing. Major Professor: Alberto Rubio.

Professional Experience:

*2018-present: Postdoc Research Associate (Power System, Microgrids, Distributed Generation, Controls & Protection), Power Systems in the Electrical and Electronics Systems Research Division - Oak Ridge National Laboratory, Oak Ridge, TN.

**2017: Electrical Engineer (III) - Electrical Substation Protection, Control & Integration Area - Casco Systems, Cumberland, ME.

*2016-2017: Postdoc Research Associate (Power System Protection) - Center for Energy Systems Research - Tennessee Technological University, Cookeville, TN.

*2015: Visiting Instructor - Burns & McDonnell K-State Smart Grid Laboratory - Electrical and Computer Engineering, Kansas State University, Manhattan, KS.

*2011-2014: Research and Teaching Assistant - Electrical and Computer Engineering, Kansas State University, Manhattan, KS.

*2007-2011: Research Assistant - American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and Mechanical Engineering, Kansas State University, Manhattan, KS.

**2006: Technical Sales Manager - Area of Electrical-Diesel Generators for Major Projects and Clients, SDMO, Buenos Aires, Argentina.

**2005-2006: Sales Engineer - Area of Power Technology, Asea Brown Boveri (ABB), Buenos Aires, Argentina.

**1998-2003: Sales Manager - Area of Power Cables for Electrical Contractors and Industries, Pirelli Power Cables and Systems, Buenos Aires, Argentina.

**1997-1998: Sales Engineer - Area of Centrifugal Pumps, Emilio Gaspareti Industrias Argentina (EGIA), Buenos Aires, Argentina

*1988-1996: Teacher and Workshop Office Head - Technologic High School No. 1, Buenos Aires, Argentina.

*Research and academic experience, **Industry experience

Professional Activities:

Industrial Activities

The activities as an Electrical Engineer (III) in the Electrical Substation Protection, Control & Integration area of CASCO Systems were:

• I performed project engineering/management tasks related to electrical distribution, transmission, generation and substation projects

• I developed power system fault analysis and arc flash studies, protection coordination calculations, protective relay settings and logic diagrams, and setting basis documents for electrical substation projects.

• I designed and commissioned electrical, control and protection systems with protective relays, remote terminal units, human-machine-interface, programmable logic controllers and others.

The activities as a Sales Manager and Engineer in the sales departments of SDMO Industries, ABB, Pirelli Power Cables & Systems, and EGIA were:

• I worked with important businesses in the energy and industrial markets, organizing the business agenda per the type of customer, amount of money, and business steps (purchase, bid, or project).

• I followed up objectives and commercial strategies using a programmed agenda of businesses, and making more effective the concretion of each business.

• I worked with energy projects defining power equipment (lay out, fuses, switches, breakers, transformers, protections, cables, generators, and others) for industrial energy facilities and utility substations.

• I calculated costs and final prices. Also, I made engineering and lab data sheets, and other technical and commercial documents for private and public bids.

• I provided post-sales technical support for the electrical products and systems sold. That allowed me to make additional profits and to determine the clients´ satisfaction.

• I participated in different international and national shows and expositions to promote new lines of products, and increase the number of clients and new projects.

Research and Teaching Activities

The activities as a Postdoc Research Associate at Oak Ridge Laboratory were:

• I installed a PSL microPMU system to monitor breaker bus voltages, currents, power and frequency.

• I worked in advanced distribution protection systems for microgrids with S&C IntelliRupter® PulseCloser Fault Interrupters.

• I studied the impact of neutral capacitor geomagnetic induced current blocking devices in distance protection relays, preparing an experiment model and manuscript.

• I collaborated in preparing list of materials, budgets and layout for a new laboratory.

• I published the "Microgrid Fault Location: Challenges and Solutions" Sandia National Laboratory report with internal and external colleagues.

• I installed a testbed with a real-time simulator and protective relays in-the-loop to perform demos and low-level amplifier and sensor interfaces for hardware in-the-loop applications.

•   I collaborated with the cyber security area in a research proposal called "Rapid digital-twin development framework for quantitative assessment of grid cyber-resilience"

The activities as a Postdoc Research Associate at Tennessee Technological University were:

•   I defined the layout for the electrical substation testbed installing the real-time simulator, protective relays, phasor measurement units, meters, power sources, relay test systems, satellite synchronized clock, remote terminal units, rack accessories and other equipment.
•   I setup the electrical substation testbed based on a real-time simulator with relays and synchrophasor system in-the-loop.
•   I performed experiments with real-time digital simulators with relays in-the-loop.
•   I wrote abstracts and proposals for research grants.
•   I prepared lectures, labs, and demos for courses integrated at Smart Grid Lab.
•   I prepared instruction manuals and lab protocols.
•   I prepared a training week on use of the real-time simulator with hardware in-the-loop at the electrical substation testbed.

The activities as a Research Assistant for the Burns & McDonnell- K-State Smart Grid Laboratory were:

•   I defined the layout for the smart grid lab installing the real-time simulator, protective relays, meters, power sources, relay test systems, satellite synchronized clock, remote terminal units, rack accessories and other equipment. I developed relay tests, experiments, demonstrations, projects and research and teaching activities applying multifunction, overcurrent, differential and distance protective relays, relay test systems and real time simulators.
•   I installed a remote metering site in the smart grid lab to collect real time data from more than 30 power meters installed across the KSU campus in collaboration with the Energy Environment Program. I developed lectures and demonstrations using power meters across the KSU campus.
•   I prepared lectures, labs and demos for courses integrated at Smart Grid Lab.
•   I advised two graduated students in their relay-in-the-loop test experiments, "Protection and Communication for a 230 kV Transmission Line using a Pilot Overreaching Transfer Tripping Scheme" by Lazaro S. Escalante De Leon. Acknowledgements at http://krex.k-state.edu/dspace/handle/2097/16899, and "Design of a Differential Protection Scheme for a 345 kV Transmission Line using SEL 311L Relays" by Tarangini K. Subrahmanyam. Acknowledgements at http://krex.k-state.edu/dspace/handle/2097/17645.

The activities as a Research Assistant for ASHRAE and Kansas State University were:

- I measured heat loss to create heat gain models for cable trays, fusible switches and breakers, NEMA motor starters, switchgears, motor control centers, panelboards, isolated and non- segregated bus bars, variable frequency drives, switch mode rectifiers and uninterruptible power supplies.
- I created a design guide to calculate heat gain of electrical and control equipment used in substations, industrial and commercial plants.

Courses:

Training and Course at Tennessee Technological University

- Advanced Smart Grid Lab Training, 2017: Introduction to real-time simulator with hardware in-the-loop, Experimental circuits, RT-LAB projects, Adaptive overcurrent protection for a microgrid with distributed generators, Bus feeder adaptive overcurrent protection, Real-time simulator with synchrophasor system in-the-loop, 10.5 contact hours/yr. (labs, demos, and projects).
- ECE7970 Intelligent Control and Protection of Power Systems (Smart grid lab integration), 2016, 23 contact hours/yr. (lectures and labs).

Courses at Kansas State University

- ECE686 Power System Protection, 2013-2015, 23 contact hours/yr. (lectures and labs).
- ECE780 Power Seminar, 2014, 2 contact hours (lecture).
- ARE533 Building Electrical Systems, 2013-2014, 2 contact hours/yr. (lectures).
- ECE511 Circuit Theory II, 2011-2012, 6 contact hours/yr. (lectures and labs).

Courses at the Technologic High School No. 1

- Electricity I. 1988-1996,12 contact hours/week, March to December (labs), course coordinator.
- Statics and Resistance of Materials. 1988-1996, 3 contact hours/week, March to December (lectures), course coordinator.
- Design of Machine Elements. 1988-1996, 3 contact hours/week, March to December (lectures), course coordinator.

Refereed Publications and Published Proceedings:

Piesciorovsky EC, Smith TM, Ollis B. Methods for Microgrid Protection. Manuscript in preparation to be submitted to The Institution of Engineering and Technology journal, IET Generation, Transmission and Distribution journal, 2019.

Piesciorovsky EC, Tarditi AG. Modeling the Impact of GIC Blocking Devices on Distance Protection Relay Operations for Transmission Lines. Manuscript in preparation to be submitted to Elsevier, Electric Power Systems Research journal, 2019.

Ferrari Maglia MF, Piesciorovsky EC, Hambrick JC, Smith TM. Validation of Low-Distortion, Amplifier Interface for Real-time Simulators with Relays In-The-Loop. Manuscript submitted to IEEE Energy Conversion Congress and Exposition, Baltimore, MD. 29 September to 3 October, 2019.

Piesciorovsky EC, Ollis B. Literature Review: Methods for Microgrid Protection. Oak Ridge National Laboratory Report, ORNL/TM-2019/1085, Power & Energy Systems, pp. 1-20, January 2019.

Piesciorovsky EC, Ferrari Maglia MF. Comparison of High-Speed Adaptive and Non-Adaptive Backup Overcurrent Protection on Fuse Feeders with Sensors. John Wiley & Sons, Ltd., International Transactions on Electrical Energy Systems, pp. 1-17, 26 December, 2018.

Tarditi AG, Dimitrovski A, Poole B, Duckworth RC, Li FR, Li Z, Liu Y, McConnell BW, Olsen RG, Poole BR, Piesciorovsky EC, Sundaresh L, Tarditi AG, Wang L, Yuan ZA. High Voltage Modeling and Testing of Transformer, Line Interface Devices, and Bulk System Components Under Electromagnetic Pulse, Geomagnetic Disturbance, and other Abnormal Transients, Grid Modernization Initiative US Department of Energy, Project Number GM0222, FY 2018 4th Quarter- Final Report, September 2018.

Hossain-McKenzie SS, Piesciorovsky EC, Reno MJ, Hambrick JC. Microgrid Fault Location: Challenges and Solutions, Sandia National Laboratory Report SAND2018-6745, pp. 1-46, June 2018.

Piesciorovsky EC, Schulz NN. Comparison of Programmable Logic and Setting Group Methods for Adaptive Overcurrent Protection in Microgrids. Elsevier, Electric Power Systems Research journal. Manuscript, vol. 151, pp. 273-282, 27 May, 2017.

Piesciorovsky EC, Schulz NN. Comparison of Non-Real-Time and Real-Time Simulators with Relays In-The-Loop for Adaptive Overcurrent Protection. Elsevier, Electric Power Systems Research journal, vol. 143, pp. 657-668, 17 November, 2016.

Piesciorovsky EC, Schulz NN. Fuse Relay Adaptive Overcurrent Protection Scheme for Microgrid with Distributed Generators. The Institution of Engineering and Technology journal, IET Generation, Transmission and Distribution, vol. 11 Issue 2, pp. 540-549, 28 September 2016.

Piesciorovsky EC, Schulz NN. Burns & McDonnell - K-State Smart Grid Laboratory: Protection, Communication & Power Metering. IEEE Power & Energy Society General Meeting, Maryland, Washington, DC Metro Area, July 27 to 31, 2014.

White WN, Piesciorovsky EC. Heat Gain from Electrical and Control Equipment in Industrial Plants, Part II. ASHRAE Research Project RP –1395. TC 9.2 Air Conditioning and Industry Committee, pp. 1-204, November 2011.

Piesciorovsky EC, White WN. Heat Gain from Power Panelboard – RP 1395. ASHRAE Summer Conference, Montreal, Canada, June 25 to 29, 2011. ASHRAE Transactions, Volume 117, pp. 1-14, Part 2, 2011.

White WN, Piesciorovsky EC. Heat Gain from Uninterruptible Power Supplies (RP-1395). ASHRAE Summer Conference, Montreal, Canada, June 25 to 29, 2011. ASHRAE Transactions, Volume 117, pp. 1-12, Part 2, 2011.

Piesciorovsky EC, White WN. Heat Gain from Adjustable Speed (Variable Frequency) Drives – RP 1395. ASHRAE Annual Conference, Albuquerque, New Mexico, June 26 to 30, 2010. ASHRAE Transactions, Volume 116, Part 2, pp. 608-617, 2011.

White WN, Piesciorovsky EC. Heat Gain from Electrical and Control Equipment in Industrial Plants, Part II (RP-1395). A.S.H.R.A.E. Annual Conference, Albuquerque, New Mexico, June 26 to 30, 2010. ASHRAE Transactions, Volume 116, Part 2, pp. 618-638, 2011.

White WN, Piesciorovsky EC. Building Heat Load Contributions from Medium and Low Voltage Switchgear, Part I: Solid Rectangular Bus Bar Heat Losses (RP- 1395). ASHRAE Annual Conference, Louisville, Kentucky, June 20 to 24, 2009. ASHRAE Transactions, vol. 115 (2) pp. 369-382, 2009.

Piesciorovsky EC, White WN. Building Heat Load Contributions from Medium and Low Voltage Switchgear Part II: Component and Overall Switchgear Heat Gains (RP - 1395). ASHRAE Annual Conference, Louisville, Kentucky, June 20 to 24, 2009. ASHRAE Transactions, vol. 115 (2) pp. 382-395, July 1, 2009.

Manuscript Referee:

IET Generation, Transmission & Distribution, 2018.

IEEE Transactions on Power Delivery, 2017.

Research Support and Collaboration:

Grid Modernization Laboratory Consortium 1.4.9 – Integrated Multi Scale Machine Learning, US Department of Energy. Lawrence Berkeley National Laboratory (Lead Performer), Oak Ridge National Laboratory and partners. $ 3,730,000. Role: Postdoc Research Associate, PI: Borges R., 2019.

Advanced protection systems for microgrids, Oak Ridge National Laboratory. $ 500,000, Role: Postdoc Research Associate, PI: Smith TM, 2018-2019.

High Voltage Modeling and Testing of Transformer, Line Interface Devices, and Bulk System Components Under Electromagnetic Pulse, Geomagnetic Disturbance, and other Abnormal Transients. Grid Modernization Initiative US Department of Energy, Oak Ridge National Laboratory. $ 2,200,000. Role: Postdoc Research Associate, PI: Tarditi AG, 2018.

Rapid digital-twin development framework for quantitative assessment of grid cyber-resilience. Laboratory Directed Research & Development Full Proposal for Director's R&D and Strategic Hire Funding. Resilient Cyber-Physical Systems Initiative, Oak Ridge National Laboratory. $ 1,915,000, Role: Co-Investigator, PI: Kerekes RA, 2018.

Synchrophasor system in the Smart Grid Lab, Center for Energy Systems Research, Tennessee Technological University. Schweitzer Engineering Laboratories. $ 24,880, PI: Piesciorovsky EC, 2016.

Activation of core at OP5600 real-time simulator in the Smart Grid Lab, Center for Energy Systems Research, Tennessee Technological University. OPAL RT. $ 22,217, PI: Piesciorovsky EC, 2016.

Installation of the Burns & McDonnell-K-State Smart Grid Lab. Electrical Power Affiliates Program at Kansas State University. $ 500,000, Role: Research Assistant and Lab Instructor, PI: Schulz NN, 2012-2014.

Heat gains from electrical and control equipment in industrial plants. American Society of Heating, Refrigerating, and Air-Conditioning Engineers. $ 192,000, Role: Research Assistant, PI: White WN, 2007-2010.

Published Abstracts and Posters:

Tarditi AG, Duckworth RC, Li FR, Li Z, Liu Y, McConnell BW, Olsen RG, Piesciorovsky EC, Poole BR, Sundaresh L, Wang L. Oak Ridge National Laboratory, Lawrence Livermore National Laboratory and University of Tennessee Knoxville, Washington State University, DOE Program Manager: K. Cheung. Testing and Modeling of HEMP and GMD Transients on High-Voltage Transformers. Grid Modernization Lab Consortium Meeting, Washington DC, September 4-7,2018.

Piesciorovsky EC, Schulz NN. Burns & McDonnell - K-State Smart Grid Laboratory: Protection, Communication & Power Metering - Integrated Smart Grid Laboratory. Proc. IEEE PES Transmission & Distribution Conference & Exposition, Chicago, Illinois, April 14 to 17, 2014.

Piesciorovsky EC, Schulz NN. Protection Power System Course and Smart Grid Laboratory Integration - Burns & McDonnell - K-State Smart Grid Laboratory. Proc. ASEE Midwest Section Annual Conference, Salina, Kansas, September 19, 2013.

Piesciorovsky EC, Schulz NN. Burns & McDonnell - K-State Smart Grid Laboratory: Protection, Communication & Power Metering - Integrated Smart Grid Laboratory. Proc. Research and the State Poster Session, Kansas State University, Manhattan, Kansas, October 29, 2013.

Reports and Lay Publications:

Piesciorovsky EC. Integrating Equipment and Software in the Smart Grid Lab: Creating a Smart Overcurrent Protective Scheme in a Radial Distribution System. EPAP Newsletter, College of Engineering, Electrical and Computer Engineering Department, Kansas State University, pp. 1, December 2014.

Piesciorovsky EC. Integrating Equipment and Software in the Smart Grid Lab, Creating a Smart Overcurrent Protective Scheme in a Radial Distribution System. Annual Report, Electrical and Computer Engineering Department, Kansas State University, pp. 2, 2013.

Smart Grid Lab Instruction Manuals and Protocols:

Piesciorovsky EC. Real Time Simulator with Synchrophasor System in the Loop, Instruction Manual. Center for Energy Systems Research, Tennessee Technological University, Cookeville, Tennessee, pp. 1-112, 2017.

Piesciorovsky EC. Real Time Simulator with Protection Systems in the Loop, Instruction Manual. Center for Energy Systems Research, Tennessee Technological University, Cookeville, Tennessee, pp. 1-127, 2017.

Piesciorovsky EC. Communication and Setting Parameters of Protective Relays, LP1-2016 Lab Protocol. Center for Energy Systems Research, Tennessee Technological University, Cookeville, Tennessee, pp. 1, 2016.

Honors and Awards:

Outstanding Graduate Student Teaching Award, Kansas State University, College of Engineering, Department of Electrical and Computer Engineering, 2014.

Notable Scholarly Graduate Student Achievement, Kansas State University, Graduate Student Council, 2010.

ASHRAE Transaction Paper Award for best paper; "Building heat load contributions from medium and low voltage switchgear part II: component and overall switchgear heat gains (RP-1395)", American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2009.

<u>Continuing Education:</u>

CAPE Training (24 hours), Computer-Aided Protection Engineering Course, 2018: Database Editor, Short Circuit, One-Line Diagram, Coordination Graphics, Relay Setting, Relay Checking, System Simulator, Line Constants, Power Flow, Short Circuit Analysis, Breaker Duty. Electrocon International Inc., Puerto Rico Electric Power Authority (PREPA), San Juan, PR, 15-18 October 2018.

CPR/AED Training (4 hours), Heart Saver First AID CPR AED - American Heart Association, Roane State Community College, Knoxville, TN, 6 June 2018.

Qualified Electrical Worker Level 2-3 Safety Training (8 hours), Oak Ridge National Laboratory, Oak Ridge, TN, 23 March 2018.

Electrical Safety Low Voltage Qualified Operator Training (8 hours), Oak Ridge National Laboratory, Oak Ridge, TN, 20 March 2018.

OPAL-RT Technologies, Regional User Seminar, Atlanta, Georgia, 15 February 2017. Panel of experts: http://www.opal-rt.com/event/regional-user-seminar/, Seminar presentation: https://www.slideshare.net/OPALRTTECHNOLOGIES/comparison-of-nonrealtime-and-realtime-simulators-with-relaysintheloop-for-adaptive-overcurrent-protection

North American Synchrophasor Initiative (NASPI) 2016, 1st International Synchrophasor Symposium, United States of America, Atlanta, 22 to 24 March 2016.

IEEE PES Transmission & Distribution Conference & Exposition, Chicago, Illinois, April 14 to 17, 2014.

OPAL RT-LAB Training Week. Burns & McDonnell – K-State Smart Grid Laboratory", 2095 Rathbone Hall, Kansas State University, October 21-24, 2013.

American Society for Engineering Education (ASEE) Midwest Section Annual Conference, Salina, Kansas, September 19, 2013.

NovaTech Overland Park Technical Symposium, Overland Park, Kansas, July 9, 2013.

NovaTech Kansas Utility Technical Symposium, Overland Park, Kansas, July 26, 2012.

Schweitzer Engineering Laboratories Product Training, Overland Park, Kansas, May 15, 2012.

ASHRAE Summer Conference, Montreal, Canada, June 25 to 29, 2011.

ASHRAE Annual Conference, Albuquerque, New Mexico, June 26 to 30, 2010.

ASHRAE Annual Conference, Louisville, Kentucky, June 20 to 24, 2009.

Public Education and Outreach:

NY Electrical Utility Visit, "Relay in-the-loop with low-level test interface and amplifier using a real-time simulator", oral presentation and demonstration, Power Systems in the Electrical and Electronics Systems Research Division, Oak Ridge National Laboratory, Oak Ridge, TN, July 19, 2018.

Real-time Simulation Seminar, "OP-4510 Real Time Simulator with Hardware in the Loop", oral presentation, Power Systems in the Electrical and Electronics Systems Research Division, Oak Ridge National Laboratory, Oak Ridge, TN, June 19, 2018.

Open House 2017, Tennessee Valley Authority Visit, "Monitoring a fault situation with PMUs and phasor data concentrator", oral presentation and demonstration, Smart Grid Laboratory, Center for Energy Systems Research, Tennessee Technological University, Cookeville, TN, March 30, 2017.

Open House 2014, "Burns & McDonnell – K-State Smart Grid Lab Introduction", video, 2095 Rathbone Hall, Kansas State University, Manhattan, KS, April 3 and 4, 2014.

EPAP Executive Meeting, "KSU student's experience and perspective", oral presentation, Kansas State University, Olathe, KS, March 12, 2013.
Open House 2013, "Temporary fault and line recloser", oral presentation and demonstration, 2095 Rathbone Hall, Kansas State University, April 20, 2013.

EPAP 2013, "Burns & McDonnell – K-State Smart Grid Laboratory", video, 2095 Rathbone Hall, Kansas State University, Manhattan, KS, September 11, 2013.

National American Power Symposium (NAPS) 2013, "Burns & McDonnell – K-State Smart Grid Laboratory", tour, video and oral presentation, 2095 Rathbone Hall, Kansas State University, Manhattan, KS, September 24, 2013.

Smart Grid Lab Dedication, "Over-current protection - Relay display sequence" video and demonstration, 2095 Rathbone Hall, Kansas State University, Manhattan, KS, October 23, 2012.

EPAP 2012, "Over current protection - Relay display sequence - Current phasor diagrams", oral presentation and demonstration, 2095 Rathbone Hall, Kansas State University, Manhattan, KS, September 5, 2012.

Professional and Academic Organizations:

Institute of Electrical and Electronics Engineers (IEEE) – Member 2013-present.

Kansas State Alumni Association – Member 2016-present

Power System Simulator, Protection, Measurement & Communication Equipment:

Power system simulators: OPAL-RT OP5600 and OP4510, CMC 256 OMICRON, SEL-AMS relay test systems, DOBLE F6150 test device, and F5850 IntelliRupter® Interface.

Microprocessor protections: SEL 451, SEL 351S, SEL 311L, SEL 411L, SEL 387L, SEL 421L protective relays, and S&C IntelliRupter® PulseCloser Fault Interrupters (Protection & Control, and Communication Modules).

Synchrophasor equipment: SEL 2407 satellite-synchronized time source, SEL synchrophasor relays, SEL 3373 phasor data concentrator, PSL microPMUs.

Communication devices: SEL 2020 and SEL 2032 communication processors, SEL-3530 real-time and Orion LX automation controllers.

Software:

Microsoft Expression Encoder 4, ETAP, PowerWorld, CAPE®, MATLAB-Simulink, RT-LAB, AcSELerator-Quickset, SEL-5401, SEL-5801, SEL-5020, SEL-5073 SYNCHROWAVE Phasor Data Concentrator System, SEL-5078-2 SYNCHROWAVE Central Synchrophasor Visualization and Analysis, IntelliLink® Setup Software, microPMU File Converter, microPMU Configurator 3.6.0.3, open PDC software, DOBLE Protection Suite, Test Universe OMICRON, NI-LabVIEW Signal Express, Redhat, Cadence (PSpice), HOMER, AutoCAD, and SAP.